No. 9600363

THE UNITED STATES OF AMERICA

TO ALL TO WHOM THESE PRESENTS SHALL COME:

The Ohio Agricultural Research and Development Center

The Ohio State University

Whereas, THERE HAS BEEN PRESENTED TO THE

Secretary of Agriculture

AN APPLICATION REQUESTING A CERTIFICATE OF PROTECTION FOR AN ALLEGED DISTINCT VARIETY OF SEXUALLY REPRODUCED, OR TUBER PROPAGATED PLANT, THE NAME AND DESCRIPTION OF WHICH ARE CONTAINED IN THE APPLICATION AND EXHIBITS, A COPY OF WHICH IS HEREUNTO ANNEXED AND MADE A PART HEREOF, AND THE VARIOUS REQUIREMENTS OF LAW IN SUCH CASES MADE AND PROVIDED HAVE BEEN COMPLIED WITH, AND THE TITLE THERETO IS, FROM THE RECORDS OF THE PLANT VARIETY PROTECTION OFFICE, IN THE APPLICANT(S) INDICATED IN THE SAID COPY, AND WHEREAS, UPON DUE EXAMINATION MADE, THE SAID APPLICANT(S) IS (ARE) ADJUDGED TO BE ENTITLED TO A CERTIFICATE OF PLANT VARIETY PROTECTION UNDER THE LAW.

NOW, THEREFORE, THIS CERTIFICATE OF PLANT VARIETY PROTECTION IS TO GRANT UNTO THE SAID APPLICANT(S) AND THE SUCCESSORS, HEIRS OR ASSIGNS OF THE SAID APPLICANT(S) FOR THE TERM OF TWENTY YEARS FROM THE DATE OF THIS GRANT, SUBJECT TO THE PAYMENT OF THE REQUIRED FEES AND PERIODIC REPLENISHMENT OF VIABLE BASIC SEED OF THE VARIETY IN A PUBLIC REPOSITORY AS PROVIDED BY LAW, THE RIGHT TO EXCLUDE OTHERS FROM SELLING THE VARIETY, OR OFFERING IT FOR SALE, OR REPRODUCING IT, OR IMPORTING IT, OR EXPORTING IT, OR CONDITIONING IT FOR PROPAGATION, OR STOCKING IT FOR ANY OF THE ABOVE PURPOSE , OR USING IT IN PRODUCING A HYBRID OR DIFFERENT VARIETY THEREFROM, TO THE EXTENT PROVIDED BY THE PLANT VARIETY PROTECTION ACT. IN THE UNITED STATES SEED OF THIS VARIETY (1) SHALL BE SOLD BY VARIETY NAME ONLY AS A CLASS OF CERTIFIED SEED AND (2) SHALL CONFORM TO THE NUMBER OF GENERATIONS SPECIFIED BY THE OWNER OF THE RIGHTS. (84 STAT. 1542, AS AMENDED, 7 U.S.C. 2321 ET SEQ.)

WHEAT, COMMON

'Hopewell'

In Testimony Whereof, I have hereunto set my hand and caused the seal of the Plant Variety Protection Office to be affixed at the City of Washington, D.C. this eighth day of May, in the year of our Lord two thousandone.

Attest:

Alan R. Pat

Acting Commissioner
Plant Variety Protection Office

Secretary of Agriculture

...CALLY. *Include form number and date on all reproductions.*

FORM APPROVED - OMB NO. 0581-0055

U.S. DEPARTMENT OF AGRICULTURE
AGRICULTURAL MARKETING SERVICE
SCIENCE DIVISION - PLANT VARIETY PROTECTION OFFICE

...CATION FOR PLANT VARIETY PROTECTION CERTIFICATE

...tructions and information collection burden statement on reverse)

The following statements are made in accordance with the Privacy Act of 1974 (5 U.S.C. 552a).

Application is required in order to determine if a plant variety protection certificate is to be issued (7 U.S.C. 2421). Information is held confidential until certificate is issued (7 U.S.C. 2426).

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1. NAME OF APPLICANT(S) *(as it is to appear on the Certificate)*

Ohio State University, Ohio Agricultural ...search & Development Center

2. TEMPORARY DESIGNATION OR EXPERIMENTAL NUMBER

OH 490

3. VARIETY NAME

HOPEWELL

4. ADDRESS *(Street and No., or R.F.D. No., City, State, and ZIP Code, and Country)*

Dept. of Horticulture & Crop Science
OSU/OARDC
1680 Madison Avenue
Wooster, OH 44691-4096

5. TELEPHONE *(include area code)*

(330) 263-3885

6. FAX *(include area code)*

(330) 263-3887

FOR OFFICIAL USE ONLY

PVPO NUMBER 9600365

FILING DATE: 09/04/96

FEES RECEIVED — FILING AND EXAMINATION FEE: $ 2450.00 DATE: 09/03/96 CERTIFICATION FEE: $ 320.00 DATE: 3/9/01

7. GENUS AND SPECIES NAME

Triticum aestivum

8. FAMILY NAME *(Botanical)*

Graminae

9. CROP KIND NAME *(Common name)*

Soft Red Winter Wheat

10. IF THE APPLICANT NAMED IS NOT A "PERSON", GIVE FORM OF ORGANIZATION *(corporation, partnership, association, etc.)* *(Common name)*

University Agricultural Experiment Station

11. IF INCORPORATED, GIVE STATE OF INCORPORATION

12. DATE OF INCORPORATION

13. NAME AND ADDRESS OF APPLICANT REPRESENTATIVE(S), IF ANY, TO SERVE IN THIS APPLICATION AND RECEIVE ALL PAPERS

~~Robert W. Gooding~~ DR. KIM CAMPBELL
~~214A Williams Hall~~ HORTICULTURE AND CROP SCIENCE
OSU/OARDC
1680 Madison Avenue
Wooster, OH 44691-4096

14. TELEPHONE *(include area code)*

AAA-11Nov1997 per letter
(330) 263-3885

15. FAX *(include area code)*

(330) 263-3887

16. CHECK APPROPRIATE BOX FOR EACH ATTACHMENT SUBMITTED *(Follow instructions on reverse)*

a. ☒ Exhibit A. Origin and Breeding History of the Variety
b. ☒ Exhibit B. Statement of Distinctness
c. ☒ Exhibit C. Objective Description of the Variety
d. ☒ Exhibit D. Additional Description of the Variety
e. ☒ Exhibit E. Statement of the Basis of the Applicant's Ownership
f. ☒ Voucher Sample *(2,500 viable untreated seeds or, for tuber propagated varieties verification that tissue culture will be deposited and maintained in a public repository)*
g. ☒ Filing and Examination Fee ($2,460), made payable to "Treasurer of the United States" *(Mail to PVPO)*

17. DOES THE APPLICANT SPECIFY THAT SEED OF THIS VARIETY BE SOLD BY VARIETY NAME ONLY, AS A CLASS OF CERTIFIED SEED? *(See Section 83(a) of the Plant Variety Protection Act)?*

☒ YES *(If "yes," answer items 18 and 19 below)* ☐ NO *(If "no," go to item 20)*

18. DOES THE APPLICANT SPECIFY THAT SEED OF THIS VARIETY BE LIMITED AS TO NUMBER OF GENERATIONS?

☒ YES ☐ NO

19. IF "YES" TO ITEM 18, WHICH CLASSES OF PRODUCTION BEYOND BREEDER SEED?

☒ FOUNDATION ☒ REGISTERED ☒ CERTIFIED

20. HAS THE VARIETY OR A HYBRID PRODUCED FROM THE VARIETY BEEN RELEASED, USED, OFFERED FOR SALE, OR MARKETED IN THE U.S. OR OTHER COUNTRIES?

☒ YES *(If "yes," give names of countries and dates)* ☐ NO

U.S. only - 1st Date of Sale, Sept. 7, 1995

21. The applicant(s) declare that a viable sample of basic seed of the variety will be furnished with application and will be replenished upon request in accordance with such regulations as may be applicable, or for a tuber propagated variety a tissue culture will be deposited in a public repository and maintained for the duration of the certificate.

The undersigned applicant(s) is(are) the owner(s) of this sexually reproduced or tuber propagated plant variety, and believe(s) that the variety is new, distinct, uniform, and stable as required in Section 41, and is entitled to protection under the provisions of Section 42 of the Plant Variety Protection Act.

Applicant(s) is(are) informed that false representation herein can jeopardize protection and result in penalties.

SIGNATURE OF APPLICANT *(Owner(s))*		SIGNATURE OF APPLICANT *(Owner(s))*	
Kimberly Garland Campbell		T. L. Payne	
NAME *(Please print or type)*		NAME *(Please print or type)*	
Dr. Kimberly Garland Campbell		Thomas L. Payne	
CAPACITY OR TITLE	DATE	CAPACITY OR TITLE	DATE
Assistant Professor	8/30/96	Director	8/30/96

SD-470 (04-96) *(Previous editions are to be destroyed)* *(See reverse for instructions and information collection burden statement)*

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Exhibit A – Origin of 'Hopewell'

Hopewell originated at the Ohio State University/Ohio Agricultural Research Center. The final cross was made in 1982. Previous experimental numbers for Hopewell were 'R19182B-33-2' and 'OH490'. The pedigree of Hopewell is: 'Logan'/'Hart'//3270A/'Rousalka'/3/TN1685/'IA22'//6767/216-6-3.

Logan (CItr 14156) was released by the Ohio State University (Ohio Agricultural Experiment Station (AES)) in 1967 (Lafever, 1968).

'Hart' (CItr 17426) was released by the University of Missouri (Missouri AES) in 1976 (Sechler et al., 1977).

32070A was an Ohio experimental line with the pedigree: $2669F_2$("S410'/Logan//Logan/'Arthur')/ Logan. S410 was a dwarf spring wheat of unknown ancestry. Arthur (CItr 14425) was released by Purdue University (Indiana AES) in 1968 (Patterson et al., 1974) .

TN1685 was an Ohio AES experimental line from the cross 'Heines VII'//Pur5752cl-7/'Talbot'. Heines VII (PI32877) was developed by Heine-Peragis Getreidezucht in Lower Saxony, Germany. Pur5752cl-7 was an Indiana AES experimental line. Talbot (CItr 13781) was developed by Agriculture Canada in 1962 (Whiteside and Gfeller, 1964).

6767 was an Ohio AES experimental line with the pedigree TN1493/Pur 5724B3-5P-8-2. TN1493 was an Ohio experimental line with the pedigree 'Redcoat'/TN1345. Redcoat (CItr 13170) was released by the Indiana AES in 1961 (Patterson et al., 1978). TN1345 was an Ohio AES experimental line with the pedigree 'Lucas/CItr 12530. Lucas (CItr 12990) was released by the Ohio AES in 1959 (Heyne, 1960).

Materials received through International Rust and Powdery Mildew Nursery Program include Rousalka (PI520076), a winter wheat cultivar developed by CIMMYT; 'IA22' (IAPAR 22-GUARAUNA) a *T. aestivum* cultivar developed in Brazil, and 216-6-3, a French experimental line of unknown pedigree possessing resistance to *Stagonospora nodorum.*

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Exhibit A - Breeding History of 'Hopewell'

1982: final cross made in the OSU-OARDC Greenhouse, designated as 'R19182B'.

1983: F_1 generation, field increase without selection on the OARDC research farm, Wooster OH.

1984: F_2 generation, field increase without selection on the OARDC research farm, Wooster OH. The population R19182B was observed to be segregating for height, head type, chaff color, and resistance to powdery mildew (*Blumeria graminis* (DC.) E.O. Speer), Stagonospora nodorum (*Stagonospora nodorum* (Berk.) Castellani & E.G. Germano), and leaf rust (*Puccinia recondita* Roberge ex Desmaz. f. sp. *tritici* (Eriks. & E. Henn.) D.M. Henderson).

1985: F_3 generation, field increase on the OARDC research farm. Thirty spikes were picked randomly to advance to the next generation.

1986: F_4 generation, head row nursery on the OARDC research farm. 30 hill plots, each containing grain from a single F_3 spike, were evaluated for height, heading date, and resistance to *B. graminis*. Two spikes were selected from a single F_4 hill plot.

1987: F_5 generation, head row nursery on the OARDC research farm. Two hill plots, each containing grain from a single F_4 spike were planted in hill plots and evaluated for height, heading date, uniformity and resistance to *B. graminis*.

1988: F_6 generation, plant row nursery on the OARDC research farm. Grain from a single F_5 hill plot was evaluated in a single row plot, 3.3m in length, for heading date, height, resistance to *B. graminis*, *S. nodorum* , standability, and uniformity. Harvested grain was evaluated for yield, test weight, and milling and baking quality

1989: F_7 generation, preliminary replicated yield trial on the OARDC research farm.

1990: F_8 generation, renamed OH490. Advanced replicated yield trial on the OARDC research farm, Wooster OH; OARDC Northwest Branch, Hoytville OH; and OARDC Western Branch, South Charleston OH. Purification head selection was begun by randomly picking 60 heads from the Wooster yield trial.

1991: F_9 generation, advanced replicated yield trial on the OARDC research farm, Wooster OH; Northwest Branch, Hoytville OH; Western Branch, South Charleston OH; and OARDC Southern Branch, Ripley OH. A separate purification head row nursery consisting of 60 head rows, each containing grain from a single F_8 spike were planted in hill plots and evaluated for similarity of heading date, height, plant and spike morphology.

1992. F_{10} generation, Statewide replicated yield trial: OSU/OARDC Research Farms: Wooster OH; Northwest Branch, Hoytville OH; Western Branch, South Charleston OH; Vegetable Crops Branch, Fremont OH; Southern Branch, Ripley OH; Mahoning County Farm, Mahoning OH; Ohio Foundation Seeds, Croton OH. Uniform Advanced Four-state Nursery: Wooster OH; West Lafayette IN; Champaign IL; Columbia MO. A separate purification plant row nursery was established from grain harvested from selected F_9 purification head rows, grown in single row plots, 3.3m in length, and evaluated for similarity of heading date, height, plant and spike morphology.

Data collected on yield trials in the F_7-F_{10} generations included fall stand, spring stand, resistance to wheat yellow mosaic virus, *B. graminis*, *S. nodorum*, *P. recondita*, heading date, height, standability, plot yield, and test weight. Milling and baking quality was evaluated in the F_7-F_{10} at the USDA-ARS Soft Wheat Quality Laboratory at Wooster OH using that laboratory's micro and advanced quality testing procedures. The F_7-F_{10} generations of OH490 were also evaluated in dedicated disease screening nurseries for resistance to *B. graminis*, *S. nodorum*, *and P. recondita.*

1993: F_{11} generation, statewide replicated yield trial, OSU/OARDC Research Farms: Wooster OH; Northwest Branch, Hoytville OH; Western Branch, South Charleston OH; Vegetable Crops Branch, Fremont OH; Southern Branch, Ripley OH; Mahoning County Farm, Mahoning OH; Ohio Foundation Seeds, Croton OH. Uniform Advanced Four-state Nursery: Wooster OH; West Lafayette IN; Champaign IL; Columbia MO. A separate purification increase nursery was established from grain harvested from selected F_{10} purification plant rows. The purification increase nursery was grown as drill strips, 4.5 ft. in width and 50 ft. in length. Selection occurred for similarity of heading date, height, plant and spike morphology.

1994: F_{12} generation, breeders seed was compiled from selected uniform purification increase drill strips and grown by Ohio Foundation Seed Inc., at Croton OH.

Fall 1994: OH490 released as 'Hopewell'.

Uniformity and stability had been observed over four generations at the time of release.

Variants: In Breeder's seed nurseries, Hopewell has shown < 0.3% total variants involving tall plants, awned spikes, and spikes exhibiting blue-green coloration.

References:

Heyne, E.G., 1960. Registration of improved wheat varieties XXIV. Agron. J. 52:655-658.

Lafever, H.N., 1968. Registration of Logan wheat. Crop Sci. 8: 511-512.

Patterson, F.L., R.L. Gallun, J.J. Roberts. 1974. Registration of Arthur wheat. Crop Sci 14:910.

Patterson, F.L., J.F. Schafer, R.L. Gallun. 1978. Registration of Redcoat wheat. Crop Sci. 18:527.

Sechler, D., J.M. Poehlman, R.P. Pfiefer, 1977. Registration of Hart wheat. Crop Sci 17:980.

Whiteside, A.G.O. and F. Gfeller, 1964. Registration of Talbot wheat. Crop Sci. 4:667.

Exhibit B: Novelty Statement

Hopewell is most similar to Freedom (Gooding et al., 1997). Hopewell differs from Freedom in that Hopewell has red chaff at maturity while Freedom has white chaff. Hopewell carries no known resistance genes to leaf rust (*Puccinia recondita* Roberge ex Desmaz. f. sp. *tritici* (Eriks. & E. Henn.) D.M. Henderson) as determined by the USDA Cereal Disease laboratory, St. Paul MN. Freedom carries the *Lr26* gene. Hopewell carries powdery mildew (*Blumeria graminis* (DC.) E.O. Speer) resistance genes *Pm2* and *Pm6* while Freedom possesses *Pm8* (Pershad et al., 1994)

Both *Lr26* and *Pm8* are present on the 1B/1R chromosome translocation derived from Petkus rye through Kavkaz which Freedom possesses (Berzonsky et al., 1990). Hopewell does not possess the 1B/1R translocation. Hopewell has no known resistance genes for Hessian Fly (*Mayetiola destructor* Say.), and Freedom possesses the *H3* gene for Hessian Fly resistance (data determined at the USDA-ARS Crop Production and Pest Control Research Unit, West Lafayette IN).

References:

Berzonsky, W.A., R.L. Clements, H.N. lafever. 1990. Identification of 'Amigo' and 'Kavkaz' translocations in Ohio soft red winter wheats (*Triticum aestivum* L.) Theor. Apl Genet. 81:629-634.

Gooding, R.L., H.N. Lafever, K.G. Campbell, L.D. Herald. 1997. Registration of Freedom wheat. Crop Sci. 37:1007.

Pershad, R. R., Lipps, P. E., and Campbell, K. G. 1994. Identification of powdery mildew resistance genes in soft red winter wheat cultivars and Ohio breeding lines. Plant Dis. 78:1072-1075).

U.S. DEPARTMENT OF AGRICULTURE
AGRICULTURAL MARKETING SERVICE
SCIENCE DIVISION
BELTSVILLE, MARYLAND 20705

EXHIBIT C
(*Wheat*)

9600363

OBJECTIVE DESCRIPTION OF VARIETY
WHEAT (*Triticum* spp.)

NAME OF APPLICANT(S)
The Ohio State University, OARDC

ADDRESS (*Street and No. or R.F.D. No., City, State, and Zip Code*)
1680 Madison Avenue
Wooster, OH 44691-4096

FOR OFFICIAL USE ONLY

PVPO NUMBER

VARIETY NAME
HOPEWELL

TEMPORARY OR EXPERIMENTAL DESIGNATION
OH 490

PLEASE READ ALL INSTRUCTIONS CAREFULLY: Place the appropriate number that describes the varietal character of this variety in the boxes below. Place a zero in the first box (e.g. [ ][ ][ ] or [ ][ ]) when number is either 99 or less or 9 or less respectively. Data for quantitative plant characters should be based on a minimum of 100 plants. Comparative data should be determined from varieties entered in the same trial. Royal Horticultural Society or any recognized color standard may be used to determine plant colors; designate system used: Yxy (CIE 1931) Color system

Please answer all questions for your variety; lack of response may delay progress of your application.

1. **KIND:**

[1] 1=Common 2=Durum 3=Club 4=Other (SPECIFY) _____

2. **VERNALIZATION:**

[2] 1=Spring 2=Winter 3=Other (SPECIFY) _____

3. **COLEOPTILE ANTHOCYANIN:**

[1] 1=Absent 2=Present

4. **JUVENILE PLANT GROWTH:**

[3] 1=Prostrate 2=Semi-erect 3=Erect

5. **PLANT COLOR (boot stage):**

[2] 1 = Yellow-Green 2 = Green 3 = Blue-Green

6. **FLAG LEAF (boot stage):**

[1] 1 = Erect 2 = Recurved [1] 1 = Not Twisted 2 = Twisted

7. **EAR EMERGENCE:**

[0][3] Number of Days Earlier Than 'Freedom' *

[ ][ ] Number of Days Later Than _____ *

8. **ANTHER COLOR:**

[1] 1 = YELLOW 2 = PURPLE

9. **PLANT HEIGHT (from soil to top of head, excluding awns):**

[ ][ ] cm Taller Than _____ *

[2.][5] cm Shorter Than Freedom *

7

* Relative to a PVPO-Approved Commercial Variety Grown in the Same Trial

10. STEM:

A. ANTHOCYANIN

[1] 1= Absent 2=Present

B. WAXY BLOOM

[2] 1=Absent 2=Present

C. HAIRINESS (last internode of rachis)

[1] 1=Absent 2=Present

D. INTERNODE (SPECIFY NUMBER) 4

[1] 1=Hollow 2=Semi-solid 3=Solid

E. PEDUNCLE

[2] 1=Absent 2=Present

[18] cm Length

11. HEAD (at Maturity):

A. DENSITY

[1] 1=Lax 2=Middense 3= Dense

B. SHAPE

[1] 1 = Tapering 2= Strap 3 = Clavate 4 = Other (SPECIFY) _____

C. CURVATURE

[1] 1 = Erect 2 = Inclined 3 = Recurved

D. AWNEDNESS

[2] 1 = Awnless 2 = Apically Awnletted 3 = Awnletted 4 = Awned

12. GLUMES (at Maturity):

A. COLOR

[2] 1 = White 2 = Tan 3 = Other (SPECIFY) _____

B. SHOULDER

[2] 1 = Wanting 2 = Oblique 3 = Rounded 4 = Square 5 = Elevated 6 = Apiculate

C. BEAK

[2] 1 = Obtuse 2 = Acute 3 =Acuminate

D. LENGTH

[2] 1 = Short (ca. 7mm) 2 = Medium (ca. 8mm) 3 = Long (ca. 9mm)

E. WIDTH

[3] 1 = Narrow (ca. 3mm) 2 = Medium (ca. 3.5mm) 3 = Wide (ca. 4mm)

13. SEED:

A. SHAPE

[1] 1 = Ovate 2 = Oval 3 = Elliptical

B. CHEEK

[1] 1=Rounded 2=Angular

C. BRUSH

[2] 1=Short 2=Medium 3=Long

D. CREASE

[2] 1 = Width 60% or less of Kernel
2 = Width 80% or less of Kernel
3 = Width Nearly as Wide as Kernel

[1] 1 = Not Collared 2 = Collared

[1] 1 = Depth 20% or less of Kernel
2 = Depth 35% or less of Kernel
3 = Depth 50% or less of Kernel

13. **SEED:** (continued)

E. COLOR

[3] 1 = White 2 = Amber 3 = Red 4 = Other (SPECIFY) _____

F. TEXTURE

[2] 1=Hard 2=Soft

G. PHENOL REACTION *(see instructions)*:

[4] 1 = Ivory 2 = Fawn 3 = Light Brown 4 = Dark Brown 5 = Black

14. **DISEASE:** (0=Not Tested; 1=Susceptible; 2=Resistant; 3=Intermediate; 4=Tolerant)

PLEASE INDICATE THE SPECIFIC RACE OR STRAIN TESTED

Stem Rust *(Puccinia graminis* f. sp. *tritici)*
[1] Lr gene(s) present but not identified

Leaf Rust *(Puccinia recondita* f. sp. *tritici)*
[1] _____

Stripe Rust *(Puccinia striiformis)*
[0] _____

Loose Smut *(Ustilago tritici)*
[0] _____

Tan Spot *(Pyrenophora tritici-repentis)*
[0] _____

Flag Smut *(Urocystis agropyri)*
[0] _____

Halo Spot *(Selenophoma donacis)*
[0] _____

Common Bunt *(Tilletia tritici* or *T. laevis)*
[0] _____

Septoria nodorum (Glume Blotch)
[3] _____

Dwarf Bunt *(Tilletia controversa)*
[0] _____

Septoria avenae (Speckled Leaf Disease)
[0] _____

Karnal Bunt *(Tilletia indica)*
[0] _____

Septoria tritici (Speckled Leaf Blotch)
[3] _____

Powdery Mildew *(Erysiphe graminis* f. sp. *tritici)*
[3] Resistance genes: Pm2/Pm6

Scab (*Fusarium* spp.)
[1] _____

"Snow Molds"
[0] _____

"Black Point" (Kernel Smudge)
[0] _____

Common Root Rot *(Fusarium, Cochliobolus* and *Bipolaris* spp.)
[0] _____

Barley Yellow Dwarf Virus (BYDV)
[3] _____

Rhizoctonia Root Rot *(Rhizoctonia solani)*
[0] _____

Soilborne Mosaic Virus (SBMV)
[3] _____

Black Chaff *(Xanthomonas campestris* pv. *translucens)*
[0] _____

Wheat Yellow (Spindle Streak) Mosaic Virus
[2] _____

Bacterial Leaf Blight *(Pseudomonas syringae* pv. *syringae)*
[3] _____

Wheat Streak Mosaic Virus (WSMV)
[0] _____

Other (SPECIFY) _____
[ ] _____

Other (SPECIFY) _____
[ ] _____

Other (SPECIFY) _____
[ ] _____

Other (SPECIFY) _____
[ ] _____

Other (SPECIFY) _____
[ ] _____

Other (SPECIFY) _____
[ ] _____

15. INSECT: (0=Not Tested; 1=Susceptible; 2=Resistant; 3=Intermediate; 4=Tolerant)

PLEASE SPECIFY BIOTYPE (where needed)

Hessian Fly *(Mayetiola destructor)*	[1]	Other (SPECIFY) [ ]
Stem Sawfly *(Cephus* spp.)	[0]	Other (SPECIFY) [ ]
Cereal Leaf Beetle *(Oulema melanopa)*	[0]	Other (SPECIFY) [ ]
Russian Aphid *(Diuraphis noxia)*	[0]	Other (SPECIFY) [ ]
Greenbug *(Schizaphis graminum)*	[0]	Other (SPECIFY) [ ]
Aphids	[0]	Other (SPECIFY) [ ]

16. ADDITIONAL INFORMATION ON ANY ITEM ABOVE, OR GENERAL COMMENTS:

Exhibit D

Additional Description of the Cultivar

As stated in Exhibit B, Hopewell is comparable to Freedom in yield potential while being three days earlier in maturity. Differences in disease resistance also exist. While Hopewell carries no identified genes for leaf rust (*Puccinia recondita* Roberge ex. Desmaz.) resistance, Freedom is resistant to prevalent races of this disease. Hopewell has no known resistance genes for Hessian Fly (*Mayetiola destructor* Say.), while Freedom possesses the H_3 gene for Hessian Fly resistance. Freedom is also resistant to all selected isolates of stem rust *(Puccinia graminis* Pers.:Pers.) while Hopewell is categorized as susceptible with Lr genes present but not identified.

Appendices

I. Color systems
II. Mature Spike Colorimeter Data
III. Leaf Colorimeter Data
IV. Yield Comparisons of Hopewell & Freedom
V. Data from Ohio Tests comparing Hopewell, Freedom, & Glory
VI. Milling Data, 1992
VII. Milling Data, 1994
VIII. Milling Data, 1995
IX. University Policy on Patents and Copyrights

Appendix I

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COLOR SYSTEMS

Minolta CR-300 series Chroma Meters offer five different color systems for measuring absolute chromaticity [CIE Yxy (1931), L*a*b* (1976), L*C*H° (1976), and XYZ (1931); Hunter Lab] and four systems for measuring color difference [Δ(Yxy), Δ(L*a*b*), Δ(L*C*H*), and Hunter Δ(Lab)]. In addition, absolute color difference ΔE^*_{ab} is also displayed when color difference is displayed in the Δ(L*a*b*) or Δ(L*C*H*) color systems, and absolute color difference ΔE is displayed in the Hunter Δ(Lab) color system.

For two colors to match, three quantities defining these colors must be identical. These three quantities are called tristimulus values X, Y, and Z as determined by the CIE (Commission Internationale de l'Eclairage) in 1931.

Color as perceived has three dimensions: hue, chroma, and lightness. Chromaticity includes hue and chroma (saturation), specified by two chromaticity coordinates. Since these two coordinates cannot describe a color completely, a lightness factor must also be included to identify a specimen color precisely.

XYZ Color System

X, Y, Z: Measured tristimulus values of specimen

The XYZ tristimulus values were defined in 1931 by the CIE, and form the basis for most calculations in all CIE color-coordinate systems.

Yxy Color System

In the Yxy (CIE 1931) color system, Y is a lightness factor expressed as a percentage based on a perfect reflectance of 100%. x and y are the chromaticity coordinates of the CIE 1931 x, y Chromaticity Diagram (shown below), and are defined by the following equations:

$$x = \frac{X}{X+Y+Z} \qquad y = \frac{Y}{X+Y+Z}$$

where

X, Y, Z: Measured tristimulus values of specimen

Color difference values ΔY, Δx, and Δy are calculated as follows:

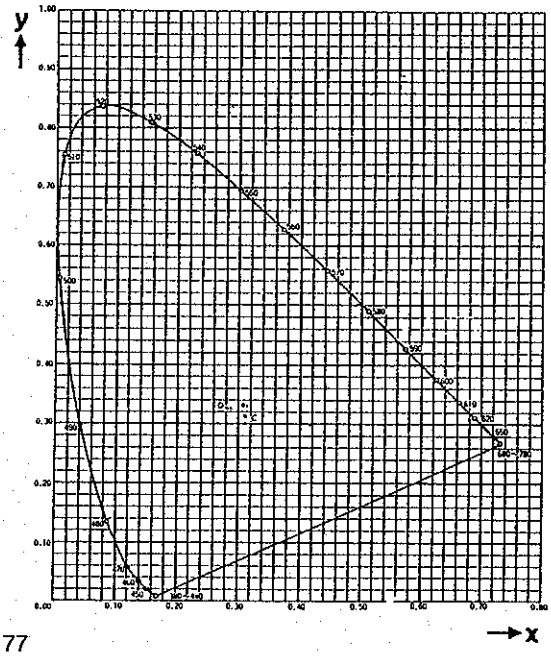
$$\Delta Y = Y - Y_t \qquad \Delta x = x - x_t \qquad \Delta y = y - y_t$$

where

Y, x, y: Measured values of specimen

Y_t, x_t, y_t: Values of target color

CIE 1931 x, y Chromaticity Diagram



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Minolta Chroma Meter Readings

Mature (Ripe) Spike Color

(From: 1996 New Variety Yield Loss Study)

PLOT	REP	Fung. Tmt.	VAR.	SAMPLE	Y	x	y
101	1	1	2	78	32.52	0.3670	0.3671
106	1	1	1	68	20.40	0.3867	0.3757
109	1	1	3	67	23.91	0.3650	0.3679
112	1	2	2	75	19.46	0.3748	0.3721
113	1	2	3	80	22.87	0.3722	0.3683
120	1	2	1	84	19.66	0.3942	0.3737
208	2	1	3	83	22.68	0.3856	0.3801
209	2	1	1	71	19.19	0.3890	0.3707
210	2	1	2	72	22.01	0.3794	0.3744
215	2	2	3	82	24.37	0.3747	0.3700
216	2	2	1	76	19.68	0.3788	0.3708
218	2	2	2	87	18.81	0.3731	0.3704
302	3	1	1	81	29.78	0.3714	0.3709
307	3	1	3	79	25.81	0.3590	0.3604
309	3	1	2	66	33.14	0.3643	0.3637
315	3	2	2	86	30.49	0.3740	0.3765
318	3	2	3	73	13.59	0.3881	0.3728
320	3	2	1	65	23.66	0.3796	0.3691
403	4	2	3	74	24.90	0.3683	0.3691
407	4	2	2	77	23.67	0.3761	0.3773
409	4	2	1	64	14.83	0.3844	0.3711
413	4	1	1	69	17.65	0.3869	0.3723
418	4	1	3	70	24.99	0.3679	0.3691
420	4	1	2	85	22.36	0.3783	0.3732

VAR.	
1	Hopewell
2	Glory
3	Freedom

FUNG. TMT	
1	Bayleton
2	No Tmt.

	Y	x	y
Hopewell	20.61	0.384	0.372
Glory	25.31	0.373	0.372
Freedom	22.89	0.373	0.370
LSD.05:	ns	0.01	ns

Appendix II

Appendix III

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Leaf (below flag leaf) Colorimeter readings of*
four Soft Red Winter Wheats
grown at Wooster, OH, 1995-96.

Var. No		Y	x	y
1	Glory	10.34	0.3243	0.3949
2	GR962	10.32	0.3253	0.3958
3	Freedom	10.68	0.3249	0.3959
4	Hopewell	11.04	0.3268	0.4283
	Mean	10.594	0.325	0.404
	LSD.05:	ns	ns	ns
	CV(%):	6.27	1.08	16.49

*Colorimeter readings by Minolta Chroma Meter Cr-300

Yield comparisons of Hopewell, Freedom, and Glory grown in drilled plots at 22 locations in Ohio, 1991-1994.

Yield (bu/a)

	1991:						1992:					1993:						1994:					22-loc.
	Woo.	S. Ch.	Mah.	Cust.	Free.	Rip.	Woo.	S. Ch.	Mah.	Free.	Rip.	Woo	S. Ch.	Mah	Cust.	Free.	Rip	Woo.	S. Ch.	Mah.	Free.	Rip.	Mean
Hopewell	67.4	47.9	43.1	58.1	58.6	52.2	100.0	30.0	70.2	114.9	54.3	73.9	53.8	68.0	47.2	80.9	87.7	66.0	58.5	62.5	92.4	76.5	66.4
Freedom	58.6	42.7	45.4	52.7	61.8	49.9	100.0	28.8	82.1	98.4	51.5	69.3	51.6	71.7	36.8	87.5	93.0	66.4	58.4	61.5	92.7	73.2	65.0
Test Mean:	64.0	45.2	42.5	52.8	59.3	51.0	90.9	33.4	75.1	108.7	51.2	72.0	50.7	63.0	41.2	88.1	82.6	63.7	53.3	56.5	90.4	74.9	
LSD.05:	2.4	2.4	5.9	3.8	4.4	5.1	7.3	5.9	9.6	11.9	4.7	4.8	1.8	3.4	2.7	3.1	5.6	3.1	5.8	6.2	ns	8.5	

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Appendix IX.

96003633

Appendix V

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Data from Ohio tests comparing Hopewell, Freedom, and Glory

Test Weight (lb/bu):

	1991 Mean (6-loc.)	1992 Mean (5-loc)	1993 Mean (6-loc)	1994 Mean (5-loc)	22-loc. Mean
Hopewell	57.7	54.1	58.1	56.5	56.6
Freedom	55.9	55.8	56.7	55.5	56.0
Glory	59.0	56.8	59.5		58.4 *

*16-locations

Date Headed (days from Jan. 1)

	1992 Mean (5-loc)	1993 Mean (6-loc)	1994 Mean (5-loc)	16-loc. Mean
Hopewell	144	145	144	144
Freedom	147	146	148	147
Glory	145	145		145 *
Test Mean:	144	145	145	
LSD.05:	1	1	1	

*11-locations

Percent Lodging

	1991 Mean (6-loc.)	1992 Mean (5-loc)	1993 Mean (6-loc)	1994 Mean (5-loc)	22-loc. Mean
Hopewell	2.2	1.0	1.1	0.9	1.3
Freedom	1.4	2.0	0.8	2.3	1.6
Glory	2.8	2.0	0.8		0.9*

* 17-locations

Plant Height (cm)

	1991 Mean (6-loc.)	1992 Mean (5-loc)	1993 Mean (6-loc)	1994 Mean (5-loc)	22-loc. Mean
Hopewell	86.4	88.9	82.8	88.4	86.4
Freedom	86.4	88.9	88.1	92.7	88.9
Glory	86.4	86.4	83.1	0.0	85.2*

* 17-locations

Appendix VI

9600363

SOFT WHEAT QUALITY EVALUATION

FOR WHEAT AND MILLING QUALITY

1992 CROP

WOOSTER, OHIO
DRILL PLOT ENTRIES

STANDARD = #144, DYNASTY

SAMPLE NO.	ENTRY	MILLING QUALITY SCORE	BAKING QUALITY SCORE	COMBINED QUALITY SCORE	TEST WT. LB/BU.	BREAK FLOUR YIELD	RED. PAS	ST. GR. FLOUR YIELD	FRIAB.	E.S.I.	FLOUR ASH	MILLAB.
*	STANDARD	100.0 A	100.0 A	100.0 A	60.3	34.8	7	76.0	28.12	10.8	0.374	108.20
*	BENCHMARK	102.0 A	107.0 A	102.0 A	61.6	35.0	8	76.6	27.60	10.4	0.349	114.31
143 OHIO	CARDINAL	108.2 A	73.4 F	73.4 F	60.0	28.81 *	7	77.2	28.62	9.67	0.348	121.05
144 OHIO	DYNASTY	100.0 A	100.0 A	100.0 A	60.3	34.80	7	76.0	28.12	10.82	0.374	108.20
145 OHIO	EXCEL	98.8 B	105.6 A	98.8 B	59.2	36.57	7	76.1	27.86	11.03	0.383	105.74
146 OHIO	FREEDOM	95.3 B	70.9 F	70.9 F	59.7	27.60 Q	7	75.8	27.61	11.57 *	0.347	108.92
147 OHIO	OH 449	92.2 C	60.4 F	60.4 F	59.7	31.15 *	7	74.9 Q	27.95	11.78 *	0.353	105.31
148 OHIO	OH 452	98.7 B	78.7 F	78.7 F	58.6 *	30.69 *	7	76.0	27.94	11.03	0.370	107.89
149 OHIO	OH 464	66.4 F	43.2 F	43.2 F	60.7	24.47 Q	8	73.7 Q	23.93 Q	14.63 Q	0.360	82.12 Q
150 OHIO	OH 470	93.6 C	60.9 F	60.9 F	59.0	30.29 *	7	75.4 *	28.04	11.98 *	0.347	107.60
151 OHIO	OH 483	90.1 C	65.6 F	65.6 F	58.3 *	31.40 *	7	75.0 Q	27.00 *	11.64 *	0.337	106.15
152 OHIO	OH 489	81.0 E	68.0 F	68.0 F	58.4 *	31.83	7	73.9 Q	26.82 *	13.07 Q	0.329	99.77
153 OHIO	~~OH 490~~ Hopewell	84.2 E	80.1 E	80.1 E	58.4 *	33.56	7	74.2 Q	27.12 *	12.66 Q	0.339	100.87
154 OHIO	OH 493	89.9 D	98.5 B	89.9 D	60.0	33.17	7	75.4 *	26.90 *	12.12 Q	0.395	95.97 *
155 OHIO	OH 498	100.3 A	90.8 C	90.8 C	60.1	30.75 *	7	75.8	28.59	10.96	0.378	107.85

SOFT WHEAT QUALITY EVALUATION

FOR FLOUR AND BAKING QUALITY

1992 CROP

9600363

WOOSTER, OHIO
DRILL PLOT ENTRIES

STANDARD = #144, DYNASTY

SAMPLE NO.	ENTRY	BAKING QUALITY SCORE	FLOUR PROTEIN %	FLOUR ASH %	MICRO A.W.R.C. %	COOKIE DIAMETER CM.	TOP GRAIN	BREAK FLOUR
*	STANDARD	100.0 A	8.63	0.374	54.5	17.87	5	34.80
*	BENCHMARK	107.0 A	8.20	0.349	51.3	18.35	7	35.00
143 OHIO	CARDINAL	73.4 F	9.24 *	0.348	52.2	17.35 *	6	28.81 *
144 OHIO	DYNASTY	100.0 A	8.63	0.374	54.5	17.87	5	34.80
145 OHIO	EXCEL	105.6 A	8.44	0.383	54.7	17.96	5	36.57
146 OHIO	FREEDOM	70.9 F	7.62	0.347	54.2	17.40 *	6	27.60 Q
147 OHIO	OH 449	60.4 F	8.54	0.353	54.8	16.77 Q	4	31.15 *
148 OHIO	OH 452	78.7 F	9.07	0.370	52.6	17.41 *	4	30.69 *
149 OHIO	OH 464	43.2 F	9.43 *	0.360	57.9 *	16.15 Q	3	24.47 Q
150 OHIO	OH 470	60.9 F	8.48	0.347	54.0	16.99 Q	4	30.29 *
151 OHIO	OH 483	65.6 F	8.76	0.337	55.4	17.19 *	4	31.40 *
152 OHIO	OH 489	68.0 F	8.40	0.329	55.3	17.23 *	5	31.83
153 OHIO	~~OH 490~~ Hopewell	80.1 E	7.99	0.339	54.5	17.42 *	6	33.56
154 OHIO	OH 493	98.5 B	7.95	0.395	53.9	17.86	6	33.17
155 OHIO	OH 498	90.8 C	8.43	0.378	52.5	17.71	6	30.75 *

SOFT WHEAT QUALITY EVALUATION
FOR WHEAT AND MILLING QUALITY

1994 CROP

DR. K.A. CAMPBELL
WOOSTER, OHIO

STANDARD = #043, FREEDOM

SAMPLE NO.	ENTRY	MILLING QUALITY SCORE	BAKING QUALITY SCORE	COMBINED QUALITY SCORE	TEST WT. LB/BU.	BREAK FLOUR YIELD	RED. PASS	ST. GR. FLOUR YIELD	FRIAB.	E.S.I.	FLOUR ASH	MILLAB.
*	STANDARD	100.0 A	100.0 A	100.0 A	57.8	36.3	7	74.9	27.79	12.0	0.381	99.37
*	BENCHMARK	106.1 A	104.7 A	104.7 A	61.6	35.0	8	76.6	27.60	10.4	0.349	114.31
43	FREEDOM	100.0 A	100.0 A	100.0 A	57.8	36.30	7	74.9	27.79	11.99	0.381	99.37
44	PION. 2548	91.6 C	93.0 C	91.6 C	58.8	41.50	7	74.1 *	26.11 Q	12.05	0.374	93.35
45	CLARK	86.7 D	92.0 C	86.7 D	59.5	35.11	8	73.7 Q	25.73 Q	12.76 *	0.352	92.96
46	OH 483	95.2 B	106.4 A	95.2 B	58.3	38.79	7	74.4	26.34 *	11.52	0.336	102.97
47	OH 489	91.7 C	106.4 A	91.7 C	58.2	41.05	7	74.3 *	26.21 Q	12.33	0.345	98.51
48	OH 490 – Hopewell	84.9 D	104.6 A	84.9 D	58.1	43.49	7	73.6 Q	26.08 Q	13.48 Q	0.356	90.78 *
49	OH 492	86.1 D	105.0 A	86.1 D	60.3	37.69	7	73.6 Q	25.97 Q	12.98 *	0.385	86.82 *
50	OH 493	80.2 E	105.3 A	80.2 E	59.3	41.71	8	73.5 Q	24.96 Q	13.77 Q	0.409 *	77.56 Q
51	OH 498	93.4 C	107.3 A	93.4 C	59.1	39.96	7	74.3 *	26.68 *	12.20	0.402	90.03 *
52	OH 506	110.0 A	110.0 A	110.0 A	59.1	39.16	7	76.9	29.79	9.66	0.346	123.39
53	OH 515	110.0 A	107.8 A	107.8 A	58.1	46.54	7	75.8	29.11	9.87	0.362	114.72
54	OH 518	95.7 B	79.9 F	79.9 F	56.7	29.52 Q	7	74.0 Q	27.05	11.46	0.360	99.19
55	OH 526	105.1 A	99.6 B	99.6 B	58.6	36.74	7	75.1	28.16	10.49	0.351	110.08
56	OH 529	96.3 B	91.8 C	91.8 C	60.1	34.23	7	74.6	26.55 *	11.53	0.357	100.32
57	OH 530	110.0 A	108.3 A	108.3 A	58.1	41.53	7	75.8	29.08	10.65	0.380	109.46

Appendix III

96000363

AUGUST 19, 1996

1995 OHIO DRILL PLOTS

CULTIVAR	TEST WEIGHT	1000 KER. WT.	MILL SCORE	ST. GR.	ESI	FRIAB	BR. FL.	FLOUR PROTEIN	FLOUR ASH	AWRC	COOKIE DIAM
LSD (revised)	1.11		2.89	0.33	0.41	0.50	1.95	0.41	0.016	1.13	0.20
FREEDOM	58.8	34.0	52.0	75.3	12.3	28.1	34.8	7.3	0.41	52.3	17.4
GR 962	60.4	39.7	54.6	75.4	11.5	28.1	36.8	8.2	0.43	52.9	18.0
HOPEWELL	61.2	41.3	51.4	75.0	11.9	27.9	37.9	8.0	0.43	54.5	18.3
OH 498	61.0	35.1	60.9	76.1	10.9	28.7	37.5	8.1	0.43	52.2	17.9
OH 515	60.9	33.4	77.2	77.5	9.4	30.8	41.2	7.8	0.37	52.6	18.0
OH 518	60.4	38.4	69.7	77.4	9.0	28.3	28.5	8.5	0.43	54.5	16.6
OH 526	61.1	36.2	61.8	76.1	10.8	28.9	34.4	8.3	0.39	51.4	17.6
OH 530	59.7	34.7	63.2	76.1	10.9	29.4	39.3	7.4	0.39	53.0	17.9
PIONEER 2548	60.8	32.3	45.3	74.5	12.1	26.8	38.8	8.8	0.45	54.3	17.1
OH 536	60.3	35.1	73.9	77.7	9.3	29.5	34.0	7.7	0.41	50.5	17.8
OH 507	61.3	34.0	78.7	77.7	8.9	30.6	36.5	8.3	0.39	51.6	17.2
OH 512	61.1	34.6	63.0	76.5	10.9	28.9	37.3	8.1	0.43	51.7	17.0
OH 532	59.5	33.8	55.5	75.6	11.1	27.8	39.2	8.0	0.45	53.9	17.8

U.S. DEPARTMENT OF AGRICULTURE
AGRICULTURAL MARKETING SERVICE
SCIENCE AND TECHNOLOGY DIVISION - PLANT VARIETY PROTECTION OFFICE

EXHIBIT E
STATEMENT OF THE BASIS OF OWNERSHIP

The following statements are made in accordance with the Privacy Act of 1974 (5 U.S.C. 552a) and the Paperwork Reduction Act (PRA) of 1995.

Application is required in order to determine if a plant variety protection certificate is to be issued (7 U.S.C. 2421). Information is held confidential until certificate is issued (7 U.S.C. 2426).

1. NAME OF APPLICANT(S)
The Ohio State University, Ohio Agricultural Research & Development Center

2. TEMPORARY DESIGNATION OR EXPERIMENTAL NUMBER
OH 490

3. VARIETY NAME
HOPEWELL

4. ADDRESS *(Street and No., or R.F.D. No., City, State, and ZIP Code, and Country)*
Dept. of Horticulture & Crop Science
OSU/OARDC
1680 Madison Avenue
Wooster, OH 44691-4096

5. TELEPHONE *(include area code)*
(330) 263-3885

6. FAX *(include area code)*
(330) 263-3887

7. PVPO NUMBER 9600363

8. Does the applicant own all rights to the variety? *Mark an "X" in appropriate block.* If no, please explain. [X] YES [ ] NO

9. Is the applicant (individual or company) a U.S. national or U.S. based company? If no, give name of country _____ [X] YES [ ] NO

10. Is the applicant the original breeder? If no, please answer the following: [X] YES [ ] NO

a. If original rights to variety were owned by individual(s): Is (are) the original breeder(s) a U.S. national(s)? If no, give name of country _____ [ ] YES [ ] NO

b. If original rights to variety were owned by a company: Is the original breeder(s) U.S. based company? If no, give name of country _____

11. Additional explantion on ownership *(If needed, use reverse for extra space):*
See attached Statement & Appendix IX

PLEASE NOTE:

Plant variety protection can be afforded only to owners (not licensees) who meet one of the following criteria:

1. If the rights to the variety are owned by the original breeder, that person must be a U.S. national, national of a UPOV member country, or national of a country which affords similar protection to nationals of the U.S. for the same genus and species.

2. If the rights to the variety are owned by the company which employed the original breeder(s), the company must be U.S. based, owned by nationals of a UPOV member country, or owned by nationals of a country which affords similar protection to nationals of the U.S. for the same genus and species.

3. If the applicant is an owner who is not the original breeder, both the original breeder and the applicant must meet one of the above criteria.

The original breeder may be the individual or company who directed final breeding. See Section 41(a)(2) of the Plant Variety Protection Act for definition.

Exhibit E

Statement of the Basis of Applicant's Ownership

The originating crosses, early line increase and evaluation, selection, reselection, testing, purification, and final multiplication were all performed by the applicant breeder (Dr. Kimberly Garland Campbell), her predecessor (Dr. H. N. Lafever) or technical assistants (Robert W. Gooding, Larry D. Herald, and Richard J Minyo) on the property of The Ohio State University, Ohio Agricultural Research and Development Center, utilizing funds provided for such research. The Ohio State University Policy on Patents and Copyrights section 1.C. affirms the University's right and policy, consistent with applicable law, of ownership of all legal rights in products of University Research. As specified by this policy, ownership of the cultivar shall remain with The Ohio State University, Ohio Agricultural Research and Development Center.